also different from the 100-mL method that was supplied with the original product and that was used by other investigators and us. The use of the smaller 50-mL calibration volume does not adequately cover the range of calf venous volumes that are closer to the neighborhood of 100 mL.

Third, the authors waited only 3 minutes between serial tests. This is far too short of time than would be necessary for a patient's arterial inflow to return to resting levels after the exercise protocol of the test. This short waiting time will result in elevated venous volumes and increased venous filling indices. Indeed, after-exercise testing of the author's design showed the greatest measurement variability. A 10-minute to 15-minute period is more appropriate to remove the confounding effect of exercise hyperemia.

Fourth, the authors had the patients' elastic stockings removed just before testing. This practice is not recommended for repeatable results because the effect of the compression garments may last up to 24 hours after their removal.[4] Thus, it is important to instruct patients not to wear their compression stockings the day of the test if one is to expect repeatable serial results.

Finally, the authors chose not to perform the key tests for outflow obstruction and superficial collateralization (by finger occlusion of the long saphenous vein).[5] Those tests, along with the protocols for reflux and calf muscle pump function, are all standard APG tests that provide the examiner with the complete hemodynamic picture of each patient who is examined. In summary, it is our belief that the authors made 2 general errors. They have modified a well-tested manufacturer's device without regard to proper engineering considerations and have also introduced a personal and deviant testing protocol. Both steps resulted in interpretation errors.

In our personal experience, the manufacturer has been quite helpful in identifying protocol problems and in helping with experimental device modifications. They should have been consulted before hemodynamic information was improperly acquired and conclusions published.

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24/41/92673

Reply

Thank you for the opportunity to reply to the comments made by Dr Goren. Dr Goren's concern appears to be focused on the concept that the APG air plethysmograph as supplied by the manufacturer ACI Medical (San Marcos, Calif) may be more accurate and more reproducible in the performance of repeated tests in patients with chronic venous disease than our study has indicated. Our concern from this study was not with any specific brand or type of air plethysmograph but rather with the inherent variability in the overall methodology in this specific group of patients. Such variability is almost certainly related to problems with this group of patients being able to consistently and accurately reproduce exactly the same degree of muscle contraction during the tiptoe movements and the same leg position, degree of immobility, and relaxation after the tiptoe movement. Variations in these parameters rather than inherent inaccuracy in the equipment is almost certainly the cause of the variation that we observed in this study.

In response to the specific points raised by Dr Goren, the device that we used consisted of the sensing cuff supplied by the manufacturer ACI Medical (Sun Valley, Calif) and a pressure transducer and recorder that was described in the paper. The sensing cuff is constructed from Dr Goren's letter polyurethane and not polyvinyl chloride as we had reported (there is no record of the material on the cuff itself). The air plethysmograph that we used was constructed separately and was not model 1000 or 1000 C or a modification of one of these. The equipment that we used produced accurate and reproducible measures of alteration in cuff volume when tested before application to patients. The same is, I assume, almost certainly the case for the APG air plethysmograph.

The testing protocol used in our study was exactly the same as the protocols that were reported previously, however, additional measurements were made on the tracings in this study, and these have not been previously reported. Before starting these studies, we evaluated the calibration volume and found a linear relationship between the 50-mL and 100-mL calibration volumes. Because the 50-mL calibration is easier to perform, this calibration was used in our studies. Because of this linear relationship, this would not have accounted for the extent of the variation in the volume parameters that were measured. We added to our protocol additional interpretation and analysis of the tracing after the patient had performed 10 tiptoe exercises. This was performed in the hope that it would provide more reproducible data, however, this was not the

case. Additional measurements made on the tracing would not have had any influence on the measurement of the standard parameters. Not evaluating the outflow obstruction of superficial collateralization would not have had any impact on the values obtained for the other measurements.

Dr Goren's point regarding the rest period between repeat tests is possibly a valid comment, and perhaps a larger rest period would theoretically result in less variation. However, if the duration of the rest period was impacting on the measurements obtained, we would have seen a consistent increase or a consistent reduction in the different parameters over the course of the 10 repeat measurements or at the comparison of the mean of the first 3 tests with the mean of the 10 tests. However, this was not the case and the repeated tests showed scattered increases and decreases in values, which indicated that there was no consistent effect resulting from previously performed tests. The rest period that we adopted is therefore unlikely to have had an effect on the measurements that were obtained.

Dr Goren's point regarding the elastic stockings is difficult to understand. If the timing of renewing the stockings had an influence on the repeated tests, it would have been observed in the same manner as described above for the rest period. However, this was not the case. To ensure the consistency of the repeated tests, which were performed on different days, we instructed the patients to remove the stockings just before the testing.

We do not dispute that the APC air plethysmograph produces accurate and reproducible measures of volume change in the sensing cuffs. Indeed, the same is the case with the air plethysmograph that was used in this study. The variability occurs when the air plethysmographic measurements are performed on patients who have had venous ulceration and is almost certainly as result of the patients' inability to precisely replicate the exercises and the posture on repeated occasions. For this reason, air plethysmography has only a limited application in monitoring treatments that are designed to improve calf muscle pump function.

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Regarding "Superior mesenteric arterial occlusion from a leiomyoma"

To the Editors:

The recent paper "Superior mesenteric arterial occlusion from a leiomyoma" from Levin et al (J Vasc Surg 1998;27:559-62) is of much interest because vascular tumors of small muscular arteries, such as the superior mesenteric artery, must be quite rare. As indicated by the authors, benign smooth muscle tumors are much more common in veins, and the aorta and pulmonary arteries are well recognized to develop sarcomas.

The authors describe superior mesenteric artery occlusion by a "leiomyoma" detected in arterial cross sections. This was noted in a surgical specimen of infarcted small bowel and colon. The authors attribute infarction of the bowel to spasm of the artery in association with this underlying "lesion". The authors demonstrate arterial luminal occlusion by a mass of smooth muscle, which they interpret as a polypoid leiomyoma.

Another interpretation of the findings is possible. On careful inspection of the figures, one can see that this leiomyoma also possesses an internal elastic lamina. Another possible interpretation of this "lesion" is that it represents a histologic artifact of vascular telescoping. In this artifact, which may be seen in small arteries or veins, a small portion of the vessel is pushed into the lumen of an adjacent segment, which often produces an onion skin or multilayered intimal effect. This would explain the "lesion" of normal vascular wall elements within the lumen of a vessel. This artifact is not rare and may be encountered with the evaluation of temporal artery biopsies and in small arteries that are present in endomyocardial biopsies. The immunostaining shown in the paper would not distinguish a leiomyoma from normal arterial media. An artifact cannot be ruled out. I have seen similar arteries interpreted as evidence of healed vasculitis, of organizing thrombus, and of fibromuscular dysplasia.

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Reply

Dr Veinot points out an interesting cause of pathologic artifacts in improperly processed arterial specimens. In the case that we reported, the intraluminal tumor was identified on gross examination of the surgical specimen, with care taken to properly lay out the superior mesenteric artery (and thereby exclude the "telescoping" referred to by Dr Veinot). Similarly, the specimen subsequently was processed properly for histology to avoid the possible development of artifacts. We appreciate Dr Veinot underscoring the meticulous attention to detail that must be part of any laboratory that processes surgical specimens.

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